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MOTOROLA PRECISION FREQUENCY PRODUCTS

1010 Frequency Standard

MODELS S1069AR and S1069BR

$ 1950.00 @ 1795.00

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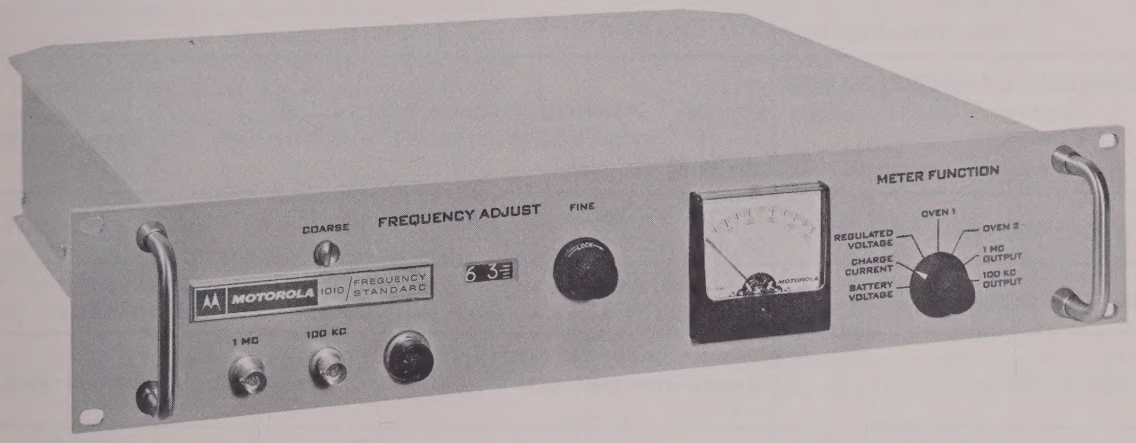
MOTOROLA

1010 FREQUENCY STANDARD

MODELS S1069AR AND S1069BR

AEPD-9434-O(CE2286-G20)



MODEL S1069AR/S1069BR FREQUENCY STANDARD UNIT

MOTOROLA INC. *Communications Division*

ENGINEERING PUBLICATIONS 4501 WEST AUGUSTA BOULEVARD CHICAGO, ILLINOIS 60651

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Issue - A

GUARANTEED PERFORMANCE SPECIFICATIONS

OUTPUT FREQUENCIES	1 mc and 100 kc at 1 V RMS sine wave into 50 ohms (front and rear panel). Spectrally pure 5 mc output optionally available (rear panel).
STABILITY $\frac{\triangle F}{F}$ (Max.) versus:	
Input Voltage Change ±10%	less than $\pm 2 \times 10^{-10}$
Load Resistance Change ±10%	less than $\pm 1 \times 10^{-10}$
Ambient Temperature 25°C ±25°C	less than 5×10^{-10} (Model S1069AR) less than $\pm 3 \times 10^{-9}$ (Model S1069BR)
Ambient Temperature 25°C ±5°C	less than $\pm 5 \times 10^{-10}$ (Model S1069BR)
TIME 24 hr.	less than 5×10^{-10} typically less than 2×10^{-10} after 60 days operation
Short-term (1 sec. avg. time)	less than $\pm 1 \times 10^{-10}$
FREQUENCY ADJUST RANGE Coarse	$\pm 2 \times 10^{-6}$ Minimum (screwdriver adjust)
Fine	1×10^{-7} indicating parts in 10^{10} (locking knob with linear digital readout)
INPUT VOLTAGE	115 VAC ±10% or 230 VAC ±10% 50-60 cps. 28.8 to 40.0 V DC
POWER CONSUMPTION	less than 20 watts at room temperature - (Model S1069AR) less than 10 watts at room temperature - (Model S1069BR)
CIRCUITRY	Two proportional control ovens, zener regulation, silicon transistors (one germanium meg-a-life unit in battery charging circuit).
OPERATING TEMPERATURE RANGE	0°C to 50°C
OUTPUT CONNECTORS	Standard BNC type
OPTIONS	Internal nickel-cadmium battery pack @ 25°C; 10 hrs for S1069AR and 24 hrs for S1069BR, 5 mc spectral purity output. Recessed screwdriver fine frequency adjust.
SIZE AND WEIGHT	19" wide x 3-1/2" high x 15" deep; approx. 18 lbs.
MODELS	S1069AR 1010 Frequency Standard (double oven) S1069BR 1010 Frequency Standard (single oven) SLN6089A 5 MC Spectral Purity Output SLN6085A Nickel-Cadmium Battery Pack

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

FOREWORD

CLAIM FOR DAMAGE IN SHIPMENT

If any damage to the shipping container is apparent upon receipt, the delivering driver should be requested to note such damage on all copies of the freight bill. This is for your protection should the material have sustained damage.

The equipment should be unpacked immediately, examined for damage and tested. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. The claim should be filed within forty-eight hours after receipt, if possible, or during a period not to exceed fifteen days.

A full report of such damage should be obtained from the claim investigator, who will call upon you. For the purpose of this report, the shipping container and all packing materials should be retained for the investigator to examine.

The investigator's report should then be forwarded to:

Motorola Communications &
Electronics, Inc.
Precision Frequency Products
Department
4501 West Augusta Blvd.
Chicago, Illinois 60651

Include model number and serial number when referring to the instrument for any reason. Arrangements for repair or replacement will be made and you will be advised of the disposition of the instrument.

REPAIR AND/OR RECALIBRATION

If desired the instrument may be returned to:

Motorola Communications &
Electronics, Inc.
Precision Frequency Products
Department
4501 West Augusta Blvd.
Chicago, Illinois 60651

for repair and/or recalibration. Before shipping the instrument notify the Precision Frequency Products Department at the above address of the service required. Refer to the instrument by model number and serial number. On receipt of this information, you will be informed of shipping instructions. If requested, an estimate of the charges will be made before work begins, provided the instrument is not covered by the warranty.

SHIPPING

The instrument should be surrounded by two or three inches of excelsior or similar shock absorbing material and then packed in a strong exterior container. It should be shipped via truck, railway express, air freight or air express.

WARRANTY

Motorola instrument equipment other than tubes, fuses, vibrators and batteries is guaranteed by Motorola, for a period of one year after delivery to the original purchaser, against defects in design, material, and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory Service Department for that purpose and to replace any defective parts thereof.

Tubes and vibrators carry their own standard manufacturer's warranty of 90 days or 1000 hours, whichever first occurs.

This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and when upon our examination it is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at the net price of necessary parts and a service charge at Motorola's then prevailing labor rate. In this case, an estimate will be submitted before the work is started.

This warranty is in lieu of all other warranties, expressed or implied and all other obligations or liabilities on Motorola's part.

If any fault develops, the following steps should be taken:

1. Notify us at the following address:

   Motorola Communications &
   Electronics, Inc.
   Precision Frequency Products
   Department
   4501 West Augusta Blvd.
   Chicago, Illinois 60651

   Give full details of the difficulty, and include model number and serial number. On receipt of this information, we will give you service data or shipping instructions.

2. On receipt of shipping instructions, forward the instrument prepaid to the above address or to the authorized repair station indicated on the instructions. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

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1. INTRODUCTION

The 1010 Frequency Standard Models are rack mounted, all solid-state (silicon) instruments that provide highly stable 1 mc and 100 kc output signals. Stability in the Model S1069AR is maintained over a wide range of ambient temperatures by enclosing the crystal in a precision double oven. The Model S1069BR Frequency Standard is a single oven version. Both ovens are proportional controlled. To insure continuous operation, and maintain frequency stability, optional nickel-cadmium batteries are employed in an arrangement such that failure of the a-c line voltage will automatically switch the frequency standard to battery power.

An auxiliary multi-pin connector (J7) is provided at the rear of the instrument for external loads. This output supplies 23.5 v d-c at 100 ma.

2. DESCRIPTION

a. General

These frequency standards essentially consist of a crystal-controlled oscillator, two frequency divider modules, a 5 mc multiplier and crystal filter, and a power supply. The basic accuracy of the unit is determined by a precise, glass enclosed, 3 mc crystal mounted in an oven and maintained accurately to a given temperature in the 80°C region. Provision is made for adjusting the internal crystal frequency without removing the unit from its case.

A precision glass piston capacitor is used for the fine frequency adjustment of the oscillator and a variable inductor is used for the coarse frequency adjustment. The inductor is housed inside the oven and has a screwdriver adjustment. A nylon tuning rod is brought out to the front panel. The fine frequency capacitor is mounted to the front panel and is adjusted by a 10-turn FREQUENCY adjustment knob with a clutch-type locking ring. The fine frequency tuning range is 990 parts in 10^{-10}, and is indicated on a digital inline readout dial.

A voltage regulator in the power supply ensures stable operating voltage whether the primary power comes from an a-c or a battery source. An overload protection circuit prevents momentary short circuits across the power supply from causing damaged or blown fuses.

The red lamp on the front panel provides an indication that a-c power is applied to the unit. In the event of a power failure this light will go out; but if a battery is used with the instrument, the unit will continue to operate from the battery supply.

b. Model Complement

The Models S1069AR and S1069BR Frequency Standards, consist of the following kits:

Kit	Description
SLN6087A	Rack-Mount Chassis without Oscillator
SLN6088A	Double Oven High Stability Oscillator
SLN6073A	Single Oven High Stability Oscillator (optional)
SLN6089A	5 MC Multiplier and Crystal Filter (optional)
SLN6090A	Screwdriver Fine Frequency Adjustment (optional)
SLN6085A	Battery Pack (optional)

3. INSTALLATION

a. Inspection

Unpack the unit and inspect the equipment for any shipping damage as detailed in the front of this manual. The frequency standard is intended for installation in a 19-inch rack and for operation from a 115/230 v a-c primary power source.

CAUTION

Before operating the frequency standard from 230 volts, a-c, refer to the instructions in paragraph 3. c..

b. 115 V AC Operation

(1) Connect the a-c line cord to a 115 volt, 50-400 cycle, a-c convenience outlet. The red indicator lamp on the front panel will light. The use of an exclusive 24-hour-a-c line will protect the unit from accidental shutdown during non-working hours and from power failures resulting from temporary overloads by other equipment.

(2) Connect the batteries by installing F3 (0.6 ampere slow blow type fuse supplied separately) in the BATTERY fuse receptacle located on the power supply sub-chassis.

(3) To determine that the unit is functioning properly, perform the following metering checks:

METER SWITCH POSITION	METER READINGS INITIALLY	METER READINGS AFTER 2 HOURS
BATTERY VOLTAGE	28-34	30-34
CHARGE CURRENT	10	10
REGULATED VOLTAGE	22-25	22-25
OVEN 1	40-50	2-10
OVEN 2	40-50	5-40
1 MC OUTPUT	10-30	10-30
100 KC OUTPUT	10-30	10-30

NOTE

If no battery is used, the battery voltage position of the metering circuit will indicate 40 on the meter.

c. 230 V AC Operation

(1) As shipped from the factory, the transformer primary is connected as shown on Diagram 63E81017A32, for 115 v a-c operation. For 230 v a-c operation perform the 230 v a-c connections, also shown on the same diagram.

(2) Connect the a-c line cord (be sure to attach a 230 v a-c plug) to a 230 v a-c convenience outlet. The red lamp on the front panel will light.

(3) Proceed with steps (2) and (3) in paragraph 3.b..

d. External DC Operation

If external d-c operation is desired, connect a 28-40 volt d-c source to the appropriate terminals on the ACCESSORY receptacle at the rear of the unit. Power input should be 40 watts for initial warm-up; 15 watts maximum for continuous operating power at room temperature.

e. Output Connections

1 MC Output: Parallel connectors are located at the front and rear of the unit. They are BNC type and will supply one volt rms into a 50 ohm resistive load.

100 KC Output: Parallel BNC connectors are located at the front and rear of the unit. They will provide one volt rms into a 50 ohm resistive load.

5 MC Output: A BNC connector is located at the rear of the unit. It will supply one volt rms into a 50 ohm resistive load.

4. OPERATION

Once the output connections are made and the meter readings found to be normal, the unit will require no attention except for periodic checks. The various controls are described in the following paragraphs.

a. FINE Frequency Adjustment

The FINE frequency adjustment knob located on the front panel provides a frequency range of 990 parts in 10^{-10}, indicating parts in 10^{-10}. Increasing digits produce an increasing frequency. The dial has a linear range between 000 and 990. Mechanical stops at either end of the adjustment indicate that the end of the linear range of the trimmer has been reached. If further change of frequency is desired, the COARSE adjust control must be used. The characteristic of the SLN6090A Screwdriver FINE frequency adjustment remains unchanged. It has a recessed slotted shaft for screwdriver operation. A protective cap is supplied to cover the access hole.

b. COARSE Frequency Adjustment

The COARSE frequency adjustment for the oscillator is accessible from the front panel by removing the knurled knob below the word COARSE Before adjusting this control, the FINE frequency adjust control should be rotated to 900 if the oscillator was aging upward, or to 100 if the oscillator was aging downward. The COARSE frequency adjustment is made by inserting a small blade screwdriver in the hole located behind the removed knurled knob. Rotation of the control in the counterclockwise direction increases frequency; rotation in the clockwise direction decreases frequency.

c. METERING Switch

The seven-position switch on the front panel provides monitoring of vital circuits in the unit and displays the reading on the front panel meter.

The various circuit checks available are as follows:

(1) BATTERY VOLTAGE: This switch position meters the battery voltage.

(2) CHARGE CURRENT: This switch position meters the battery charging current. If the battery pack is used, the meter reading should be 10.

(3) REGULATED VOLTAGE: This switch position meters the constant voltage regulator output voltage. A meter reading between 22 and 25 should be obtained, and remain constant in a given unit.

(4) OVEN 1: This switch position meters the current in the inner oven heater winding. A meter reading between 40 and 50 should be obtained during warm-up; a reading between 3 and 5 should be obtained after warm-up.

(5) OVEN 2: This switch position meters the current in the outer oven heater winding. A meter reading between 40 and 50 should be obtained during warm-up; a reading between 5 and 40 should be obtained after warm-up, depending upon the ambient temperature.

NOTE

The oven #2 meter reading is the same as for oven #1

(6) 1 MC OUTPUT: This switch position meters the amplitude of the 1 mc signal. When the output is properly terminated in a 50 ohms resistive load, a meter reading between 10 and 15 should be obtained.

(7) 100 KC OUTPUT: This switch position meters the amplitude of the 100 kc signal. When the output is properly terminated in a 50 ohms resistive load, a meter reading between 10 and 15 should be obtained.

5. THEORY OF OPERATION

a. Introduction

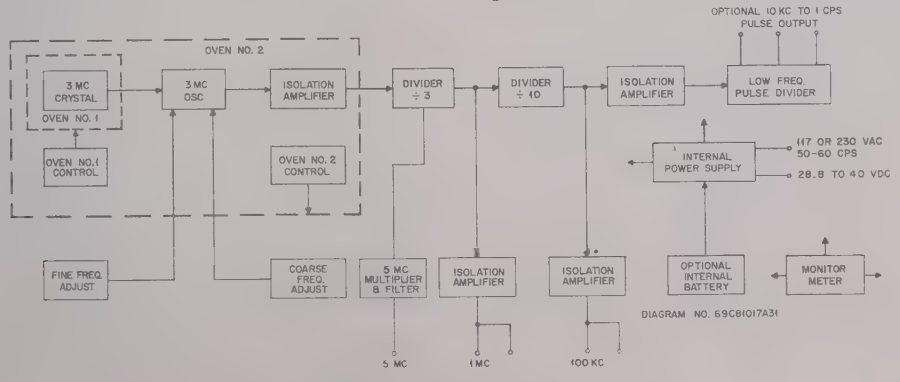
The Models S1069AR and S1069BR Frequency Standards consist of the following major items:

(1) Oscillator Package
(2) Divider Circuitry
(3) 5 MC Multiplier and Crystal Filter
(4) Power Supply

Each of these items will be discussed in detail with respect to its contribution to performance of the unit. (Refer to Block Diagram 69C81017A31 and Schematic Diagram 63E81017A32 in this manual.)

A 3 mc glass enclosed crystal was selected as being well suited to provide good stability and low aging over a long period of time. A transistor oscillator employing stabilized circuitry and low drive level for the precision crystal is used to ensure the utmost in performance. An isolation amplifier provides isolation of the oscillator circuitry from external load effects. A high-gain, proportional-control inner oven circuit maintains the crystal at a predetermined temperature to within a few milli-degrees. In the Model S1069AR a similar outer-oven control circuit maintains the temperature of the inner oven assembly as well as the entire oscillator circuitry. The effects of ambient temperature changes on the circuits contained in the ovens are thus greatly reduced.

Fail-safe divider circuits produce the desired 100 kc and 1 mc output frequencies. A power supply incorporating a temperature-compensated, highly-stable, solid state regulator is used to eliminate the effects of voltage variations on the output frequencies. Optional nickel-cadmium batteries are employed for standby operation and are connected to immediately power the unit in the event of a power failure. The charging current for these batteries is provided by the power supply.



BLOCK DIAGRAM

b. Oscillator

The oscillator transistor parameters are relatively temperature and age insensitive. It operates at low power levels with low noise, since noise contributes to short-term instabilities. Furthermore, it has a high ratio of maximum frequency to operating frequency to ensure little phase shift through it. Changes in phase shift due to aging and other variations consequently are also small.

c. Dividers

Two regenerative divider circuits are used to provide the 1 mc and 100 kc frequency standard outputs. The first divider (see Schematic Diagram 63E81017A32 and Circuit Board Detail CEPD-8998) receives the 3 mc output from the isolation amplifier. The signal is coupled via two buffer stages (Q101 and Q102) whose function is to minimize loading. It is amplified by Q103 and coupled to the emitter of mixer stage, Q104. The collector circuit of Q104 is tuned to 1 mc. A capacitive tap in the tuned circuit couples the 1 mc signal to Q105, where it is doubled in frequency. The 2 mc signal in the collector circuit of Q105 is fed back to the base circuit of Q104, where it mixes with the incoming 3 mc signal to produce a 1 mc signal. This signal is taken from a capacitive tap in the mixer stage and applied to the base of amplifier Q106. Capacitive taps in the 1 mc tuned circuit of Q106 apply the signal to the 1 mc output connectors at the front and rear of the frequency standard.

Diode CR101 and capacitor C119 supply a d-c voltage to the metering circuitry on the front panel of the unit for an indication of the presence of the 1 mc signal.

The second divider (see Schematic Diagram 63E81017A32 and Circuit Board Detail CEPD-8998) is similar in operation to the first divider. Q201, the isolation amplifier, amplifies the 1 mc signal, couples it to Q202, the mixer stage, where it is mixed with 900 kc to produce 100 kc. The resultant 100 kc signal is multiplied by Q203 to 900 kc and fed back to the mixer stage, Q202, where it mixes with the incoming 1 mc signal to produce the 100 kc signal. This signal is taken from a capacitive tap on the mixer stage, Q202, and applied to the base of amplifier Q204. A capacitive tap on the 100 kc tuned circuit of Q204 applies the signal to the 100 kc output connectors at the front and rear of the frequency standard.

Metering of the 100 kc output is performed by rectifying a portion of the signal at CR201 and supplying it to the panel meter via metering switch S1.

d. 5 MC Multiplier and Crystal Filter

A 1 mc signal taken from the collector of Q104 is fed to input emitter follower Q301 and then to x5 multiplier Q302. The amplified 5 mc output signal is applied to amplifier Q303 and the resultant output is filtered by the circuit consisting of crystal Y301 and associated capacitors which has a bandpass of approximately 30 cps. The output of the filter is amplified by Q304 and coupled to the 5 mc connector via the double-tuned output circuits. The 5 mc output signal level is regulated by rectifiers CR301 and CR302 which supply an AGC control voltage to amplifier Q303.

e. Power Supply

The frequency standard operates from a 50 to 400 cps, single-phase primary source of 115/230 volts, a-c ±10%. The power supply delivers 23.5 v d-c from an electronic regulator with a capacity sufficient to operate the unit. The power supply also delivers sufficient power to charge standby batteries through a constant current charging circuit. The standby batteries are floated across the electronic regulator input so that in the event of primary power failure the battery supply automatically provides power to the electronic regulator without interruption.

Transformer T1 supplies primary a-c to the bridge rectifier consisting of CR1, CR2, CR3 and CR4. Approximately 40 v d-c is impressed across filter capacitor C3 and applied to the regulator circuits.

Transistor Q3 functions as a series current regulator, and Q1, Q2 and Q4 sense and regulate the output voltage. Zener diode CR8, via Q4, establishes a fixed voltage reference level. Q4 utilizes this reference level at its emitter to sense power supply output voltage changes appearing across R7 and R8. DC changes at the base of Q4 are therefore amplified and, with Q4 collector tied to the base of Q2, change the base voltage which results in a voltage change at the emitter of Q2. The emitter of Q2 is common with the base of series regulator Q3, and consequently controls the voltage drop across Q3.

Transistor Q5 is employed in a constant current battery charging circuit to provide a continuous charging current to the internal battery. DC voltage from the bridge rectifier provides for proper operating voltage and the value of resistor R9 is selected to supply collector current consistent with charging requirements of the battery pack. Diode CR12 is biased with 40 v d-c on the cathode and 31 v d-c on the anode during normal a-c operation of the unit and no current can be drawn from the battery. Should a-c power fail, the cathode voltage is removed, the diode conducts, and battery voltage is fed to the regulator circuits through the closed contacts of relay K1.

The frequency standard will operate normally from the internal batteries. Operation beyond the battery limits will result in the voltage decreasing beyond a usable level and subsequent deterioration of the standard output signals. Since the 1 mc and 100 kc outputs can be expected to become unreliable at this time, and to prevent complete discharge from resulting in possible damage to the batteries, relay K1 and Zener diode CR13 are employed to sense the battery voltage and to disconnect the batteries from further discharge when the available voltage drops below 20 v d-c.

Relay K1 is normally held energized by d-c derived either from the bridge rectifier or (in the event of power failure) the internal batteries. Once the unit begins operating from the internal batteries, K1 becomes self-holding via its contacts 1 and 2 and energizing current flows through the coil and the series connected Zener diode. When the available d-c from the batteries drops below 20 v d-c, Zener diode CR13 ceases conducting and relay K1 de-energizes, opening relay contacts 1 and 2 and disconnecting the batteries from further drain.

External d-c power can be used to operate the frequency standard as a primary source (instead of 115/230 v a-c) or as an emergency standby supply. In either event, internal batteries may be left in place. An external d-c source of 28-40 v d-c can be connected to the unit at pins A and C on the ACCESSORY receptacle. With the unit operating from an a-c line, diode CR14 is back biased by the power supply rectifier output. An a-c line failure removes the bias and operation of the unit will be from external d-c or internal battery, whichever voltage is greater.

Momentary short circuits across the power supply output will not damage the unit. During a short circuit, load current is limited by design of the regulator to 1 amp. In addition, slow blow type fuse F2 will not open for approximately 60 seconds. Removal of the short will return operation of the unit to normal.

Should the short persist for more than 60 seconds, fuse F2 will open, removing the d-c voltage input from the unit. The battery voltage will then be applied through relay K1 contacts to the regulator, but fuse F3 (0.6 amp) will immediately open from the over load and remove power from the unit.

LINE fuse F1 and ACCESSORY fuse F4 are located at the rear of the frequency standard and are accessible from outside the unit. Fuses F2 and BATTERY fuse F3 are located on the power supply sub-chassis.

6. MAINTENANCE

a. General

This instrument should be serviced by personnel qualified in maintaining laboratory test equipment. It is an accurate, sensitive device and should be treated as such. When qualified personnel or adequate test instruments are not available, the equipment should be returned to the factory for service or recalibration. Refer to the FOREWORD for detailed instructions.

b. Dust Cover Removal

To gain access to either the top or bottom of the unit, remove two screws from the dust cover and slide the cover toward the rear of the unit.

c. Calibration

Periodic calibration adjustments against a known frequency standard should be made. The adjustments should be carried out by following information presented in paragraphs 4.a. and 4.b.. Should the instrument fail to respond to the adjustments in the manner described, the possibility of a malfunction in the high stability oscillator unit is indicated. Do not attempt to service the unit. It must be returned to the factory for repair.

d. Power Supply Test

The power supply maintains an output voltage of approximately 23.5 volts to within ±.1 volt for input voltages from 105 to 130 v a-c. If a component has been replaced, it is necessary

to check the voltage regulation before returning the unit to service. To do this, vary the input voltage with a "Variac" between 105 and 130 v a-c and check the output voltage of the power supply with a voltmeter. If proper regulation is taking place, the voltage will not vary more than ±. 1 volt.

e. General Alignment Consideration

The frequency standard requires very little maintenance. Transistors, being inherently reliable devices, do not normally require replacement for the life of the instrument. Should it become apparent that realignment is necessary, use the procedure outlined in this section.

Test equipment for this purpose should be of laboratory quality and subject to scheduled preventive maintenance and calibration.

f. 3 MC to 1 MC Divider Alignment Procedure

(Refer to Circuit Board Detail CEPD-8998)

(1) Connect a 50 ohm resistive load to the 1 mc output connector.

(2) Connect the oscilloscope horizontal external sweep to the 50 ohm lead, and the vertical sweep (input) to the collector of Q103.

(3) Adjust the slugs of L102 and L103 until a 3:1 Lissajous figure is obtained. If not enough output signal is obtained to produce a usable Lissajous figure, the slug of L104 may be adjusted.

(4) Repeat step (3) until the slugs of L102 and L103 are adjusted for optimum operation.

(5) Connect the vertical input of the oscilloscope to the 1 mc output connector. Trigger the oscilloscope internally.

(6) Adjust L104 for a maximum undistorted waveform on the oscilloscope. The output voltage should be at least 1.0 volt, rms.

g. 1 MC to 100 KC Divider Alignment Procedure

(Refer to Circuit Board Detail CEPD-8967)

(1) Connect a 50 ohm resistive load to the 100 kc output connector.

(2) Connect the oscilloscope horizontal external sweep to the 50 ohm load and the vertical sweep (input) to the 1 mc output connector.

(3) Adjust the slugs of L202 and L203 for a 10:1 Lissajous figure. If not enough output signal is obtained to produce a usable Lissajous figure, the slugs of L204 and L205 may be adjusted.

(4) Repeat step (3) until the slugs of L202 and L203 are adjusted for optimum operation.

(5) Connect the vertical input of the oscilloscope to the 100 kc output connector. Trigger the oscilloscope internally.

(6) Adjust L204 and L205 for a maximum undistorted waveform on the oscilloscope. The output voltage should be at least 1.0 volt, rms.

h. 5 MC Multiplier and Crystal Filter Alignment Procedure

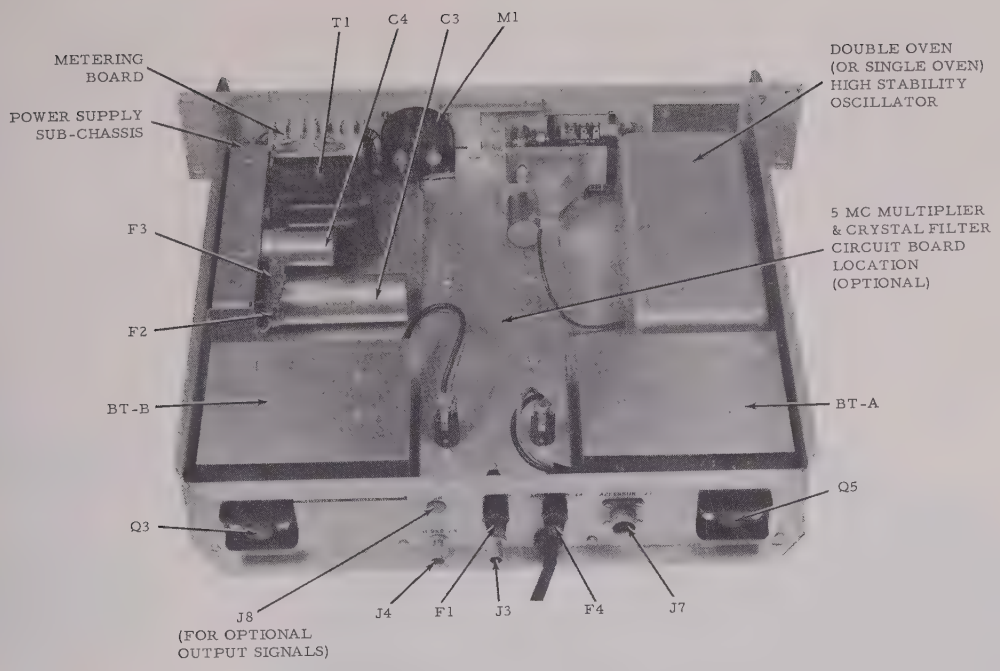
(Refer to Circuit Board Detail CEPD-9821)

The adjustment for this module requires only that its tuned circuits be periodically peaked since the bandpass of this circuit is controlled primarily by the "Q" of crystal Y301.

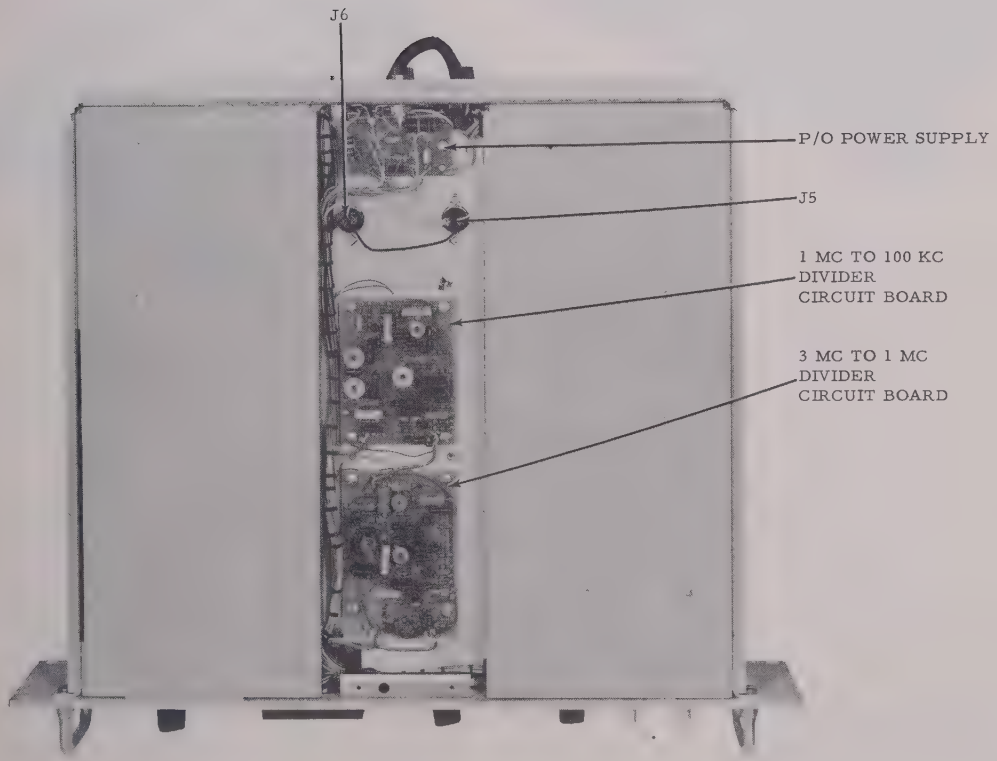
(1) Place a d-c voltmeter probe at the junction of C317, CR301 and CR302. Connect a 50 ohm resistive load and an oscilloscope probe at the 5 mc output jack (J8).

(2) Adjust L302, C312 and C320 for minimum d-c voltage and maximum r-f output voltage. Adjust C323 for maximum r-f output voltage.

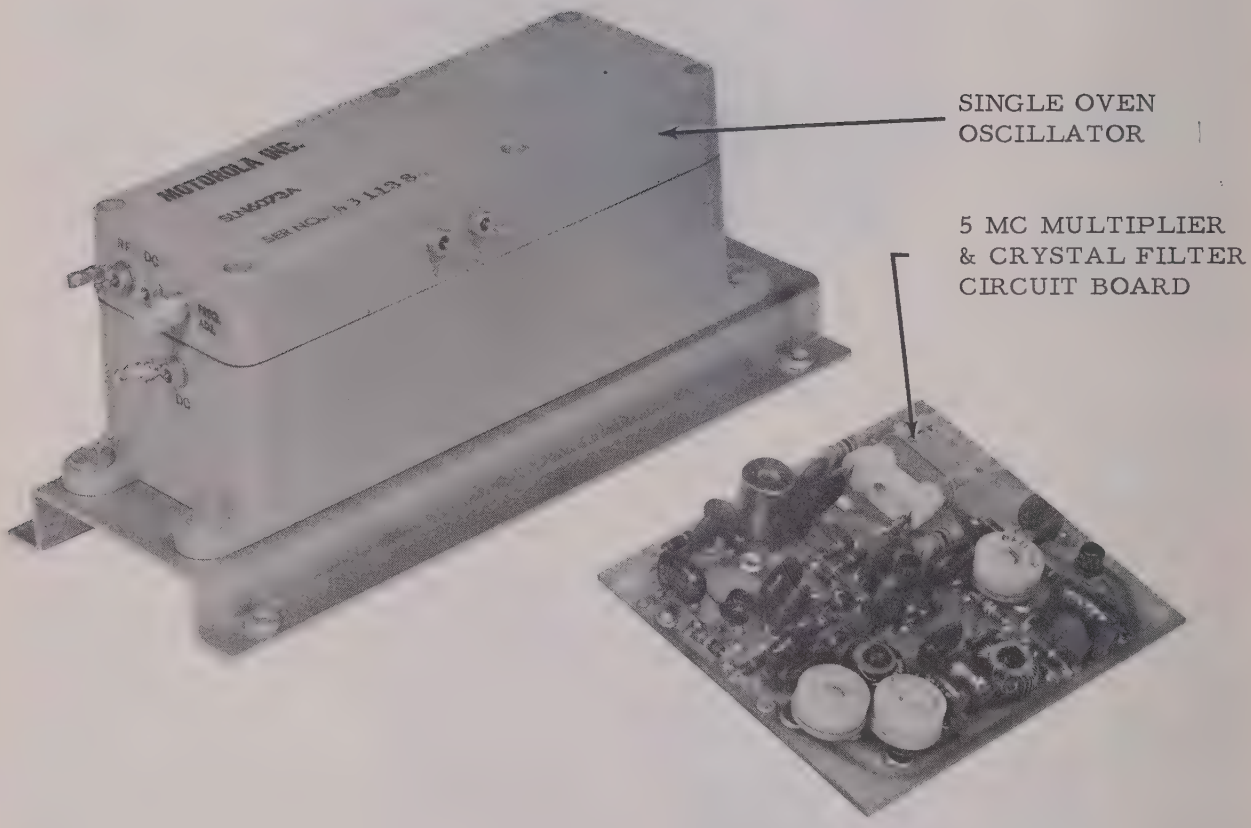
(3) Repeat step (2) for maximum r-f output voltage. It should be a minimum of 1 v, rms at 5 mc.



Parts Location Detail, Top View

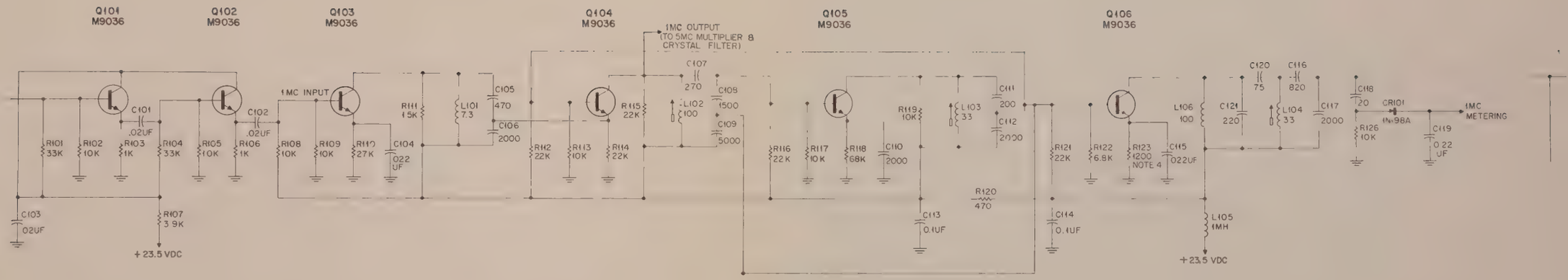


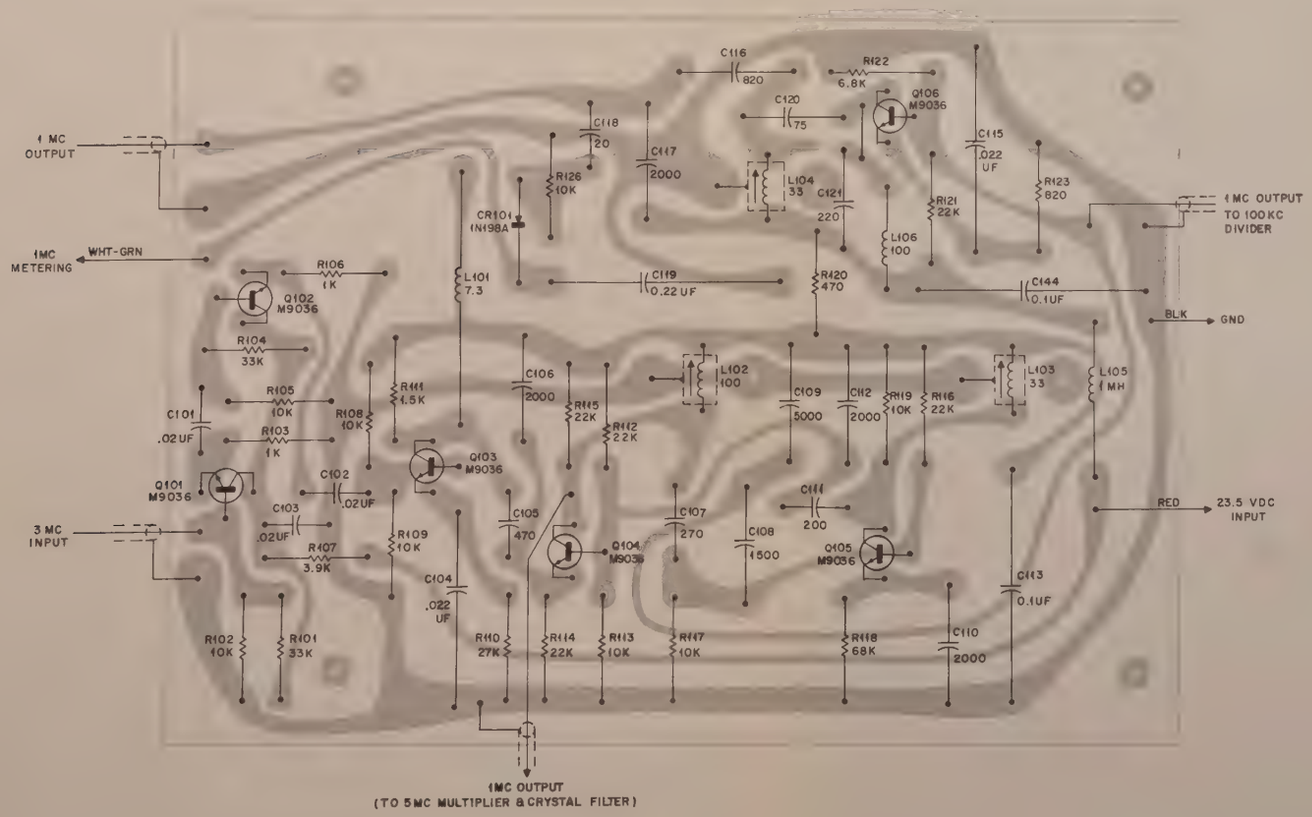
Parts Location Detail, Bottom View



Single Oven Oscillator and 5 MC Multiplier
and Crystal Filter Options
Motorola No. AEPD-8118-O

EPD-8999-A DEPD-9000-O





PREVIOUS REVISIONS LISTED ON BACK OF THIS DIAGRAM

3 MC to 1 MC Divider
Circuit Board Detail
Motorola No. EPD-8998-A

REVISIONS

DIAG ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A			CIRCUIT BOARD OUTLINE ADDED	

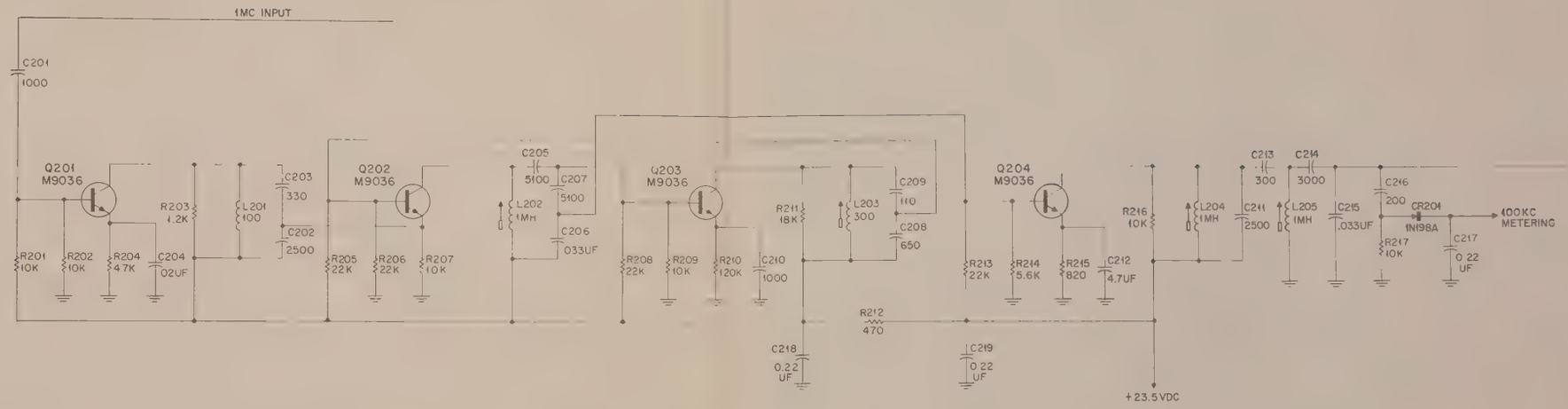
Replacement parts orders for components which do not show a Motorola part number must include the instrument model number, component reference symbol and the description which appears in the parts list.

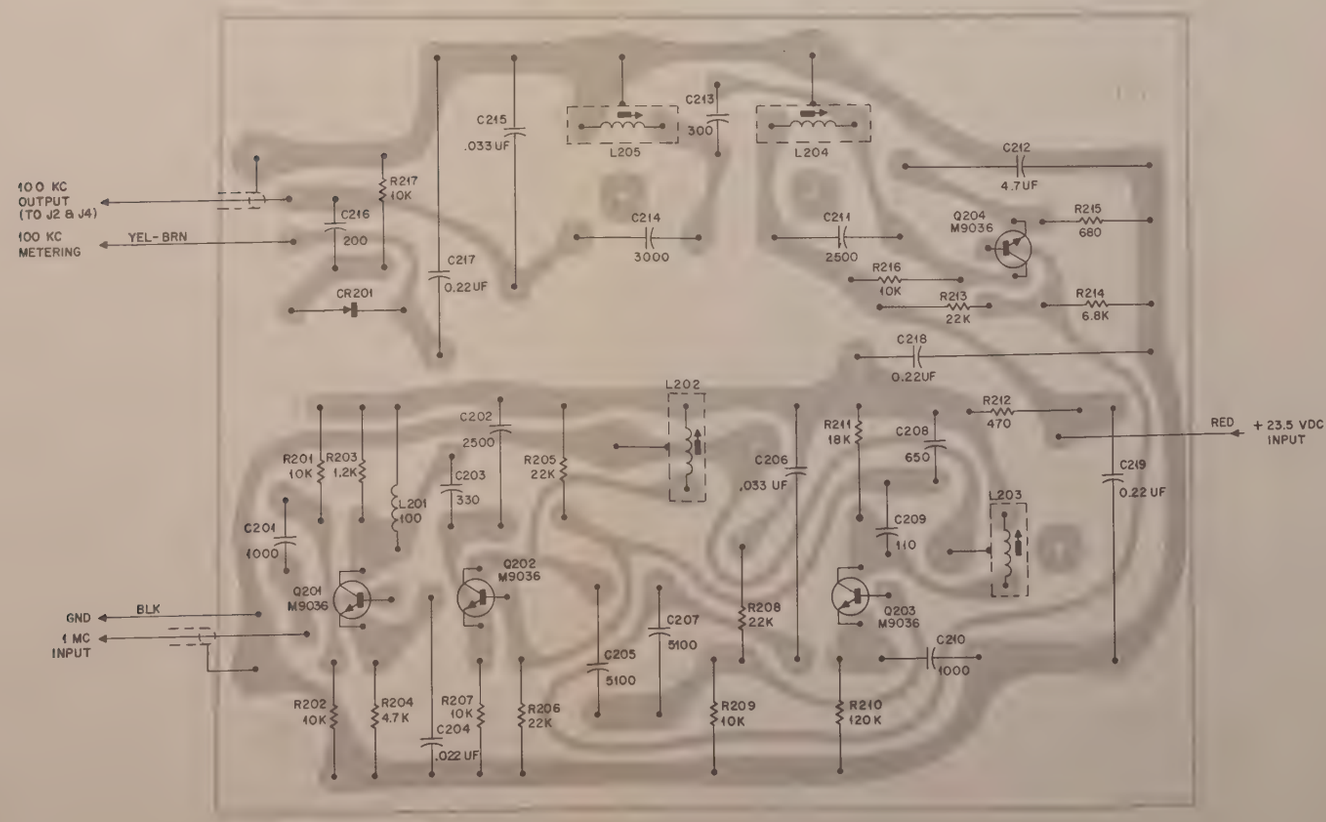
3 MC to 1 MC Divider Circuit Board EPD-8998-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf: ±5%; 500 v; unless stated
C101, 102, 103	21K832502	.02 uf +60-40%; 250 v
C104, 115		.022 uf ±10%; 200 v
C105	21K82537B06	470; 300 v
C106, 110, 112, 117	21K859948	2000
C107	21K859178	270; 300 v
C108	21K863291	1500 ±2%
C109	21K857481	5000
C111	21K840812	200
C113, 114		0.1 uf ±10%; 200 v
C116	21K873269	820 ±2%; 300 v
C118	21K859940	20
C119	8K868594	0.22 uf ±10%; 100 v
C120	21K859938	75 ±5%; 500 v
C121	21K865956	220 ±3%; 500 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR101		germanium; 1N198A
		COIL, RF:
L101	24K859166	fixed; 7.3 uh
L102	24B82027E01	adjustable; 100 uh
L103, 104	SPC24B4139-1	adjustable; 33 uh
L105		fixed; 270 uh
L106		fixed; 100 uh
		TRANSISTOR: N-P-N, (NOTE)
Q101, 102, 103, 104, 105, 106	48R869036	silicon: M9036
		RESISTOR, fixed: ±10%; 1/4 w; unless stated
R101, 104	6K127807	33K
R102, 105, 108, 109, 113, 117, 119, 126	6K129225	10K
R103, 106	6K127802	1K
R107	6K129232	3.9K
R110	6K127806	27K
R111	6K127803	1.5K
R112, 114, 115, 116, 121	6K128685	22K
R118	6K129144	68K
R120	6K127801	470
R122	6K128687	6.8K
R123	6K129432	820

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.





1 MC to 100 KC Divider
Circuit Board Detail
Motorola No. EPD-8967-O

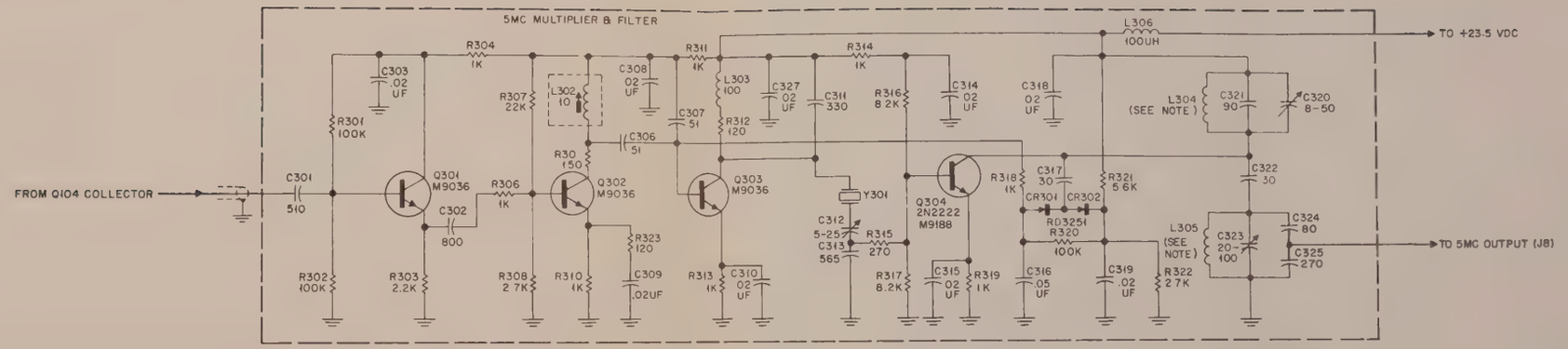
Replacement parts orders for components which do not show a Motorola part number must include the instrument model number, component reference symbol and the description which appears in the parts list.

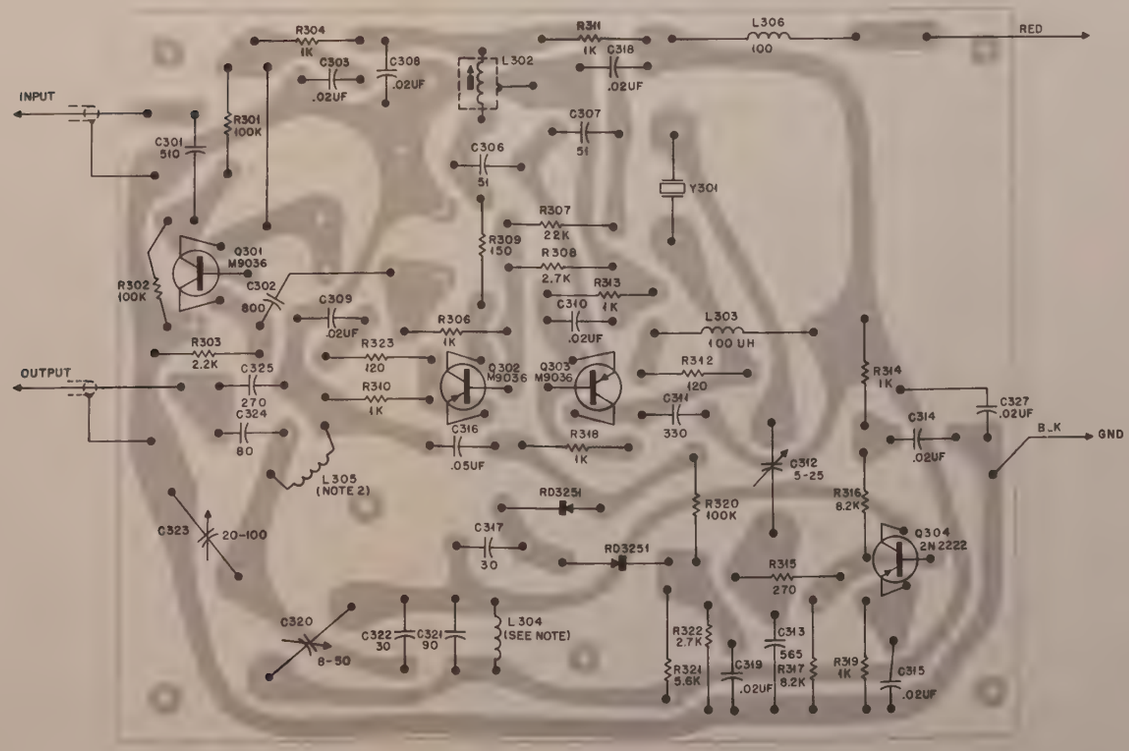
1 MC to 100 KC Divider Circuit Board EPD-8967-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf: ±5%; 500 v: unless stated
C201, 210	21K847601	1000
C202, 211	21K859773	2500
C203	21K873267	330 ±2%
C204		.022 uf ±10%; 200 v
C205, 207	21K874354	5100; 300 v
C206, 215		.033 ±10%; 200 v
C208	21K848236	650; 300 v
C209	21K865445	110 ±3%
C212	23K865137	4.7 uf ±20%; 25 v
C213	21K859944	300
C214	21K863395	3000 ±2%
C216	21K840812	200
C217, 218, 219	8K868594	0.22 uf ±10%; 100 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR201		germanium; 1N198A
		COIL, RF:
L201		fixed; 100 uh
L202, 204, 205		adjustable; 1 mh
L203	24B82027E02	adjustable; 300 uh
		TRANSISTOR: N-P-N, (NOTE)
Q201, 202, 203, 204	48R869036	silicon; M9036
		RESISTOR, fixed: ±10%; 1/4 w:
R201, 202, 207, 209, 216, 217	6K129225	10K
R203	6K129235	1.2K
R204	6K127804	4.7K
R205, 206, 208, 213	6K128685	22K
R210	6K128987	120K
R211	6K128904	18K
R212	6K127801	470
R214	6K129433	5.6K
R215	6K129432	820

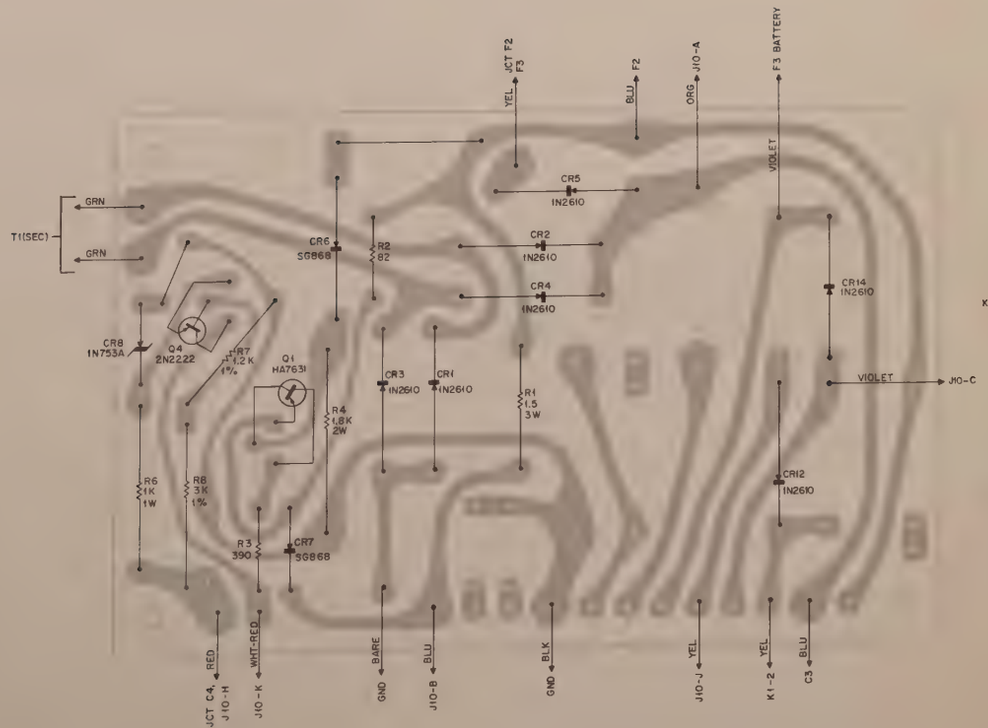
NOTE:

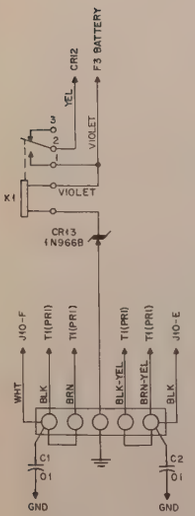
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

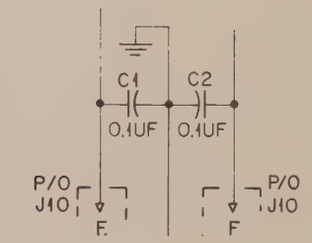


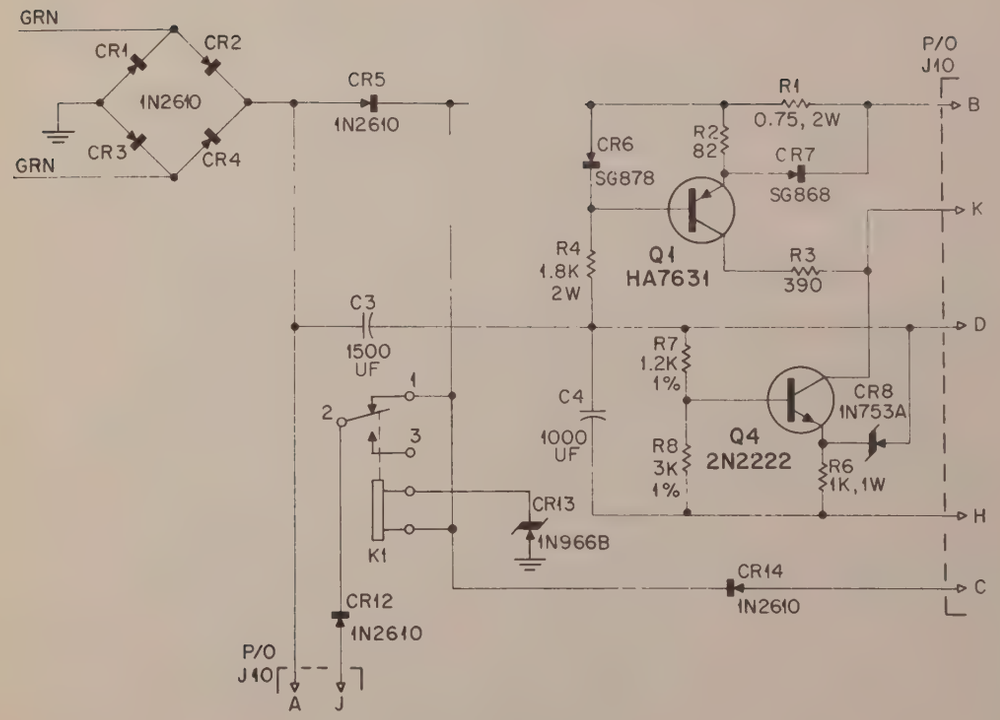


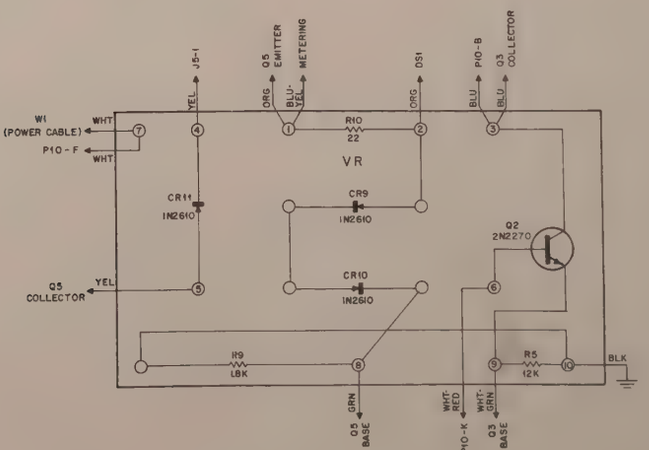
5 MC Multiplier and Crystal Filter
Circuit Board Detail
Motorola No. EPD-9821-O



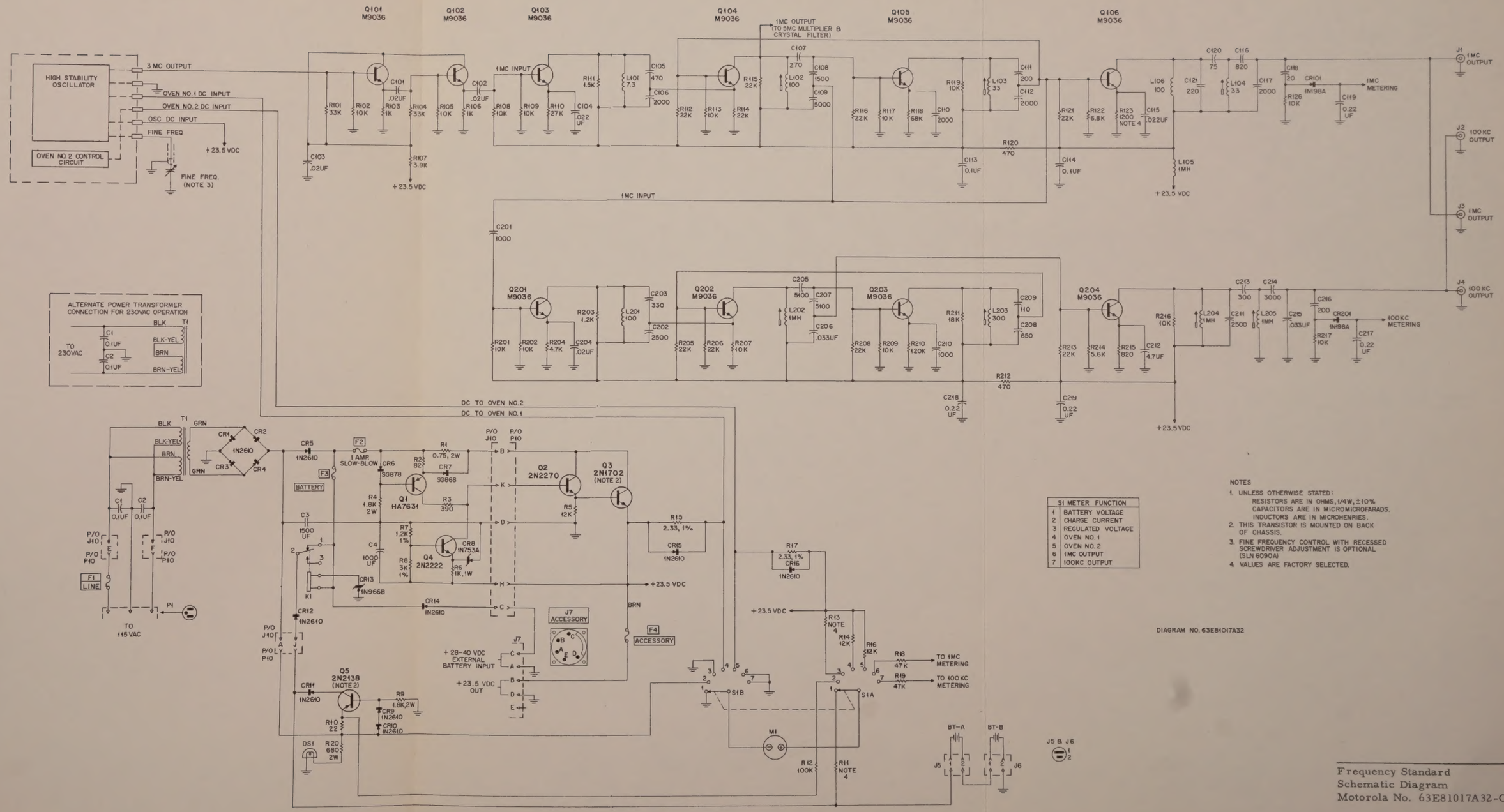








Power Supply
Circuit Board Detail
Motorola No. EPD-8969-O



Frequency Standard
Schematic Diagram
Motorola No. 63E81017A32-O

Replacement parts orders for components which do not show a Motorola part number must include the instrument model number, component reference symbol and the description which appears in the parts list.

PARTS LIST for diagram 63E81017A32-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR15, 16		silicon; 1N2610
		CONNECTOR, receptacle:
J1, 2, 3, 4, 8	9B855268	female; coaxial; type BNC
J5, 6	28A812540	male; 2 contact
J7, 8		male; 5 contact
		AMMETER:
M1	SPC72C4148	arbitrary scale
		RESISTOR, fixed:
R11		(factory-selected)
R12	6K129225	100K ±10%; 1/4 w
R13		(factory-selected)
R14, 16	6K129230	12K ±10%; 1/4 w
R15, 17	17C82476B02	2.33 ±1%; 3 w
R18, 19	6K128902	47K ±10%; 1/4 w
		SWITCH, rotary:
S1	SPC40B3645	2 section; 12 position

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MP MASTER
MA36330